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(54) **Diesel composition comprising ethanol**

(57) The present invention provides a diesel composition having an excellent ignitability despite inclusion of ethanol therein. The diesel composition includes a diesel base material, ethanol in a range from 5 to 30% by weight based on the total amount of the diesel base material, and ethyl nitrite or ethyl nitrate in a range from 0.5 to 7%

by weight based on the total amount of the diesel base material. The content of the ethyl nitrite or ethyl nitrate falls within a range of 50% by weight or less of the content of the ethanol, and the ethyl nitrite or ethyl nitrate is derived from ethanol as a raw material.

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a diesel composition.

Description of the Related Art

[0002] For the purpose of preventing the global warming, the reduction of the emission of carbon dioxide has recently been demanded, and various means have been proposed for that purpose. As one of such means, it has been known the use of ethanol or the like obtained through the fermentation of plant substances, for example, such as agricultural crops including sugarcane and corn in combination with the subsequent distillation for automotive fuel and the like.

[0003] As for the plant substances, plants themselves to be raw materials have already absorbed carbon dioxide. Therefore, even when the plant substances themselves are burned, the quantity of the emitted carbon dioxide is equal to the quantity of the carbon dioxide having been absorbed by the plants concerned; thus, there can be attained the so-called carbon neutral effect such that the quantity of the emitted carbon dioxide is theoretically zero in total. In this connection, it is known that ethanol, one of the plant substances, is mixed in gasoline to be used as a gasoline engine fuel (see, Japanese Patent Laid-Open No. 2005-29761).

[0004] On the other hand, diesel engines can be found among internal combustion engines capable of reducing fuel consumption and emission matter. The diesel engine is driven by the compressed self ignition of a fuel such as diesel, and it is known that the diesel engine is small in the emission of carbon dioxide. Accordingly, it is conceivable that if ethanol can be mixed in the diesel, such mixing will further enjoy an advantage from the aspect of reducing the emission of carbon dioxide.

[0005] However, when ethanol is used for the fuel of the diesel engine, there occurs such a disadvantage that ethanol has a low ignitability, and accordingly a fuel mixed with ethanol has also a reduced ignitability.

SUMMARY OF THE INVENTION

[0006] An object of the present invention is to provide, through overcoming such a disadvantage, a diesel composition having an excellent ignitability despite inclusion of ethanol therein.

[0007] For the purpose of achieving such an object, the diesel composition of the present invention is characterized by including a diesel base material, and ethanol in a range from 5 to 30% by weight based on the total amount of the diesel base material and ethyl nitrite or ethyl nitrate in a range from 0.5 to 7% by weight based on the total amount of the diesel base material.

[0008] The diesel composition of the present invention includes, together with the above described range of ethanol, the above described range of ethyl nitrite or ethyl nitrate, and accordingly, can acquire an excellent ignitability despite inclusion of ethanol. It is known that as a cetane number improver to improve the ignitability of the diesel, an alkyl nitrate having 6 or 8 carbon atoms is used (Japanese Patent No. 3102934). However, it has not yet been known that ethyl nitrite or ethyl nitrate is used as the above described cetane number improver.

[0009] When the content of the ethanol is less than 5% by weight based on the amount of the diesel base material, no effect of reducing the emission of carbon dioxide is attained. When the content of the ethanol exceeds 30% by weight based on the amount of the diesel base material, the ignitability in the diesel engine is degraded, and a decrease in the output power is also caused due to the decrease in the generated heat per unit volume.

[0010] When the content of the ethyl nitrite or ethyl nitrate is less than 0.5% by weight based on the amount of the diesel base material, the ignitability of the diesel composition containing ethanol cannot be improved. When the content of the ethyl nitrite or ethyl nitrate exceeds 7% by weight based on the amount of the diesel base material, no further advantageous effect can be attained.

[0011] In the diesel composition of the present invention, the content of the ethyl nitrite or ethyl nitrate preferably falls within a range of 50% by weight or less of the content of the ethanol. When the content of the ethyl nitrite or ethyl nitrate exceeds 50% by weight of the content of the ethanol, the ignition delay time varies widely leading to such a problem that a vibration is generated.

[0012] The ethyl nitrite or ethyl nitrate may be synthesized through any types of reaction paths, but is preferably derived from ethanol as a raw material. The ethyl nitrite or ethyl nitrate improves the ignitability of the diesel composition containing ethanol, and, on the other hand, contributes to the reduction of the emission of carbon dioxide in cooperation with ethanol, through the use of ethanol as a raw material.

[0013] When ethanol is used as a raw material, the ethyl nitrite may be obtained from the reaction between ethanol

and nitrous acid, and the ethyl nitrate may be obtained from the reaction between ethanol and nitric acid.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

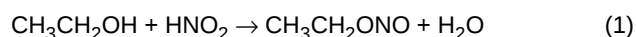
[0014] Hereinbelow, an embodiment of the present invention is described in more detail.

[0015] The diesel composition of the present embodiment is characterized by including a diesel base material, and ethanol in a range from 5 to 30% by weight based on the total amount of the diesel base material and ethyl nitrite or ethyl nitrate in a range from 1 to 7% by weight based on the total amount of the diesel base material.

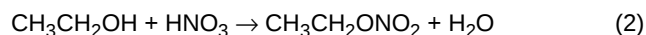
[0016] The ethanol may be synthesized industrially, but preferably is derived from plants as raw materials from the viewpoint of reducing the emission of carbon dioxide. Examples of ethanol derived from plants as raw materials may include, for example, ethanol obtained by fermentation of agricultural crops such as sugarcane and corn in combination with the subsequent distillation.

[0017] The ethyl nitrite or ethyl nitrate may be synthesized through any types of reaction paths, but is preferably derived from ethanol as a raw material from the viewpoint of reducing the emission of carbon dioxide.

[0018] When ethanol is used as a raw material, the ethyl nitrite may be obtained from the reaction between ethanol and nitrous acid as shown in the following formula (1):



[0019] The ethyl nitrate may be obtained from the reaction between ethanol and nitric acid as shown in the following formula (2):



[0020] Hereinbelow, examples and a comparative example of the present invention are described.

Reference Example

[0021] In the present Reference Example, the ignitability of heptane (C_7H_{16} ; boiling point: 98.4°C) as a diesel base material was first tested. The ignitability test was carried out by measuring the ignition delay time by use of a fuel spray ignition analyzer (tradename: FIA-100; manufactured by Fuel Tech, Inc.) with a combustion chamber set at a temperature of 500°C and a pressure of 2 MPa. The result is shown in Table 1.

Example 1

[0022] In the present Example, a diesel composition composed of 90% by weight of heptane as the diesel base material, 8.5% by weight of ethanol and 1.5% by weight of ethyl nitrite was first prepared.

[0023] Next, the ignitability of the diesel composition prepared in the present Example was tested in exactly the same manner as in the above Reference Example. The result is shown in Table 1.

Comparative Example 1

[0024] In the present Comparative Example, a diesel composition composed of 90% by weight of heptane as the diesel base material and 10% by weight of ethanol, but not containing ethyl nitrite at all was prepared.

[0025] Next, the ignitability of the diesel composition prepared in the present Comparative Example was tested in the exactly same manner as in the above Reference Example. The result is shown in Table 1.

Example 2

[0026] In the present Example, a diesel composition composed of 90% by weight of heptane as the diesel base material and 7.0% by weight of ethanol and 3.0% by weight of ethyl nitrite was prepared.

[0027] Next, the ignitability of the diesel composition prepared in the present Example was tested in the exactly same manner as in the above Reference Example. The result is shown in Table 1.

Example 3

[0028] In the present Example, a diesel composition composed of 80% by weight of heptane as the diesel base material and 17.0% by weight of ethanol and 3.0% by weight of ethyl nitrite was prepared.

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[0029] Next, the ignitability of the diesel composition prepared in the present Example was tested in the exactly same manner as in the above Reference Example. The result is shown in Table 1.

Example 4

[0030] In the present Example, a diesel composition composed of 70% by weight of heptane as the diesel base material and 25.5% by weight of ethanol and 4.5% by weight of ethyl nitrite was prepared.

[0031] Next, the ignitability of the diesel composition prepared in the present Example was tested in the exactly same manner as in the above Reference Example. The result is shown in Table 1.

Example 5

[0032] In the present Example, a diesel composition composed of 90% by weight of heptane as the diesel base material and 8.5% by weight of ethanol and 1.5% by weight of ethyl nitrate was prepared.

[0033] Next, the ignitability of the diesel composition prepared in the present Example was tested in the exactly same manner as in the above Reference Example. The result is shown in Table 1.

TABLE 1

	Heptane (wt%)	Ethanol (wt%)	Ethyl nitrite (wt%)	Ethyl nitrate (wt%)	Ignition delay time (ms)
Ref. ex.	100	--	--	--	5.67
Ex. 1	90	8.5	1.5	--	5.14
Comp. ex. 1	90	10	--	--	7.31
Ex. 2	90	7.0	3.0	--	4.42
Ex. 3	80	17.0	3.0	--	5.53
Ex. 4	70	25.5	4.5	--	5.62
Ex. 5	90	8.5	--	1.5	5.22

[0034] As can be clearly seen from Table 1, the diesel composition of Comparative Example 1 composed of 90% by weight of heptane and 10% by weight of ethanol is longer in ignition delay time and lower in ignitability than the diesel composition of Reference Example composed of 100% of heptane, but the diesel composition of Example 1 composed of 90% by weight of heptane, 8.5% by weight of ethanol and 1.5% by weight of ethyl nitrite is shorter in ignition delay time and better in ignitability than the diesel composition of Reference Example.

[0035] As can also be clearly seen from Table 1, the diesel compositions of Examples 2 to 4 each composed of 70 to 90% by weight of heptane, 7 to 25% by weight of ethanol and 3.0 to 4.5% by weight of ethyl nitrite and the diesel composition of Example 5 using ethyl nitrate in place of ethyl nitrite used in Example 1 are all shorter in ignition delay time and better in ignitability than the diesel composition of Reference Example.

[0036] The present invention provides a diesel composition having an excellent ignitability despite inclusion of ethanol therein. The diesel composition includes a diesel base material, ethanol in a range from 5 to 30% by weight based on the total amount of the diesel base material, and ethyl nitrite or ethyl nitrate in a range from 0.5 to 7% by weight based on the total amount of the diesel base material. The content of the ethyl nitrite or ethyl nitrate falls within a range of 50% by weight or less of the content of the ethanol, and the ethyl nitrite or ethyl nitrate is derived from ethanol as a raw material.

Claims

1. A diesel composition, comprising:

a diesel base material;
ethanol in a range from 5 to 30% by weight based on the total amount of the diesel base material; and
ethyl nitrite or ethyl nitrate in a range from 0.5 to 7% by weight based on the total amount of the diesel base material.

2. The diesel composition according to claim 1, wherein the content of the ethyl nitrite or ethyl nitrate falls within a

range of 50% by weight or less of the content of the ethanol.

3. The diesel composition according to claim 1, wherein the ethyl nitrite or ethyl nitrate is derived from ethanol as a raw material.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005029761 A [0003]
- JP 3102934 B [0008]